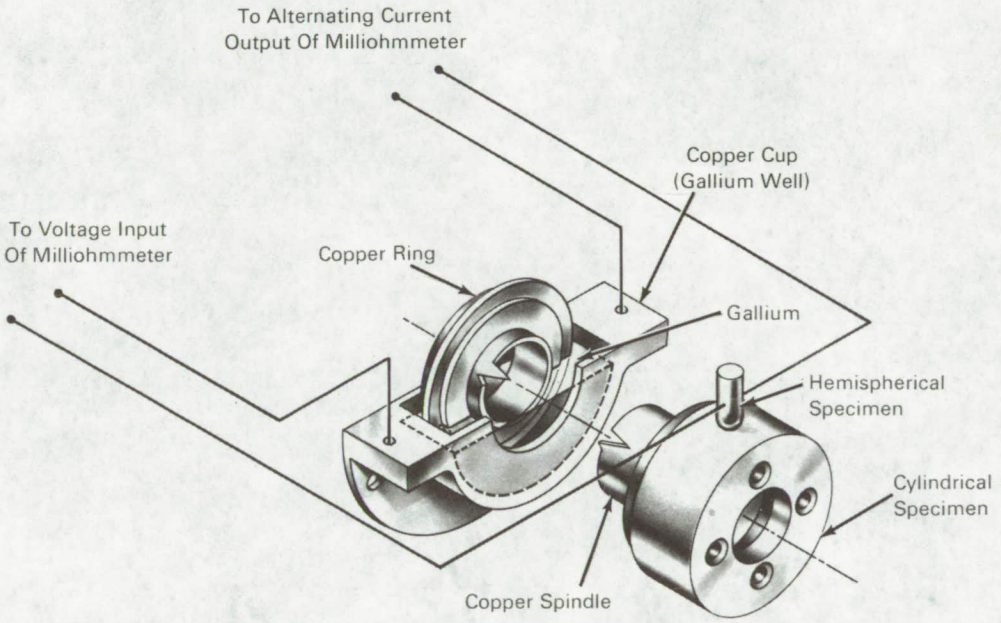
NASA TECH BRIEF

Liquid Gallium Rotary Electric Contact



One of the most formidable problems encountered in an ultrahigh vacuum (10^{-11} torr) environment is the transmission of substantial amounts of electrical current to rotating components. The basis for the problem lies in the selection of a slip ring having little or no wear, a very long maintenance-free life and low electrical loss. Under ordinary atmospheric conditions, the liquid mercury slip ring fulfills all of these requirements, but due to the prohibitively high vapor pressure of mercury, this simple, reliable slip ring system cannot be used in ultrahigh vacuum.

Gallium, which has a very low vapor pressure, was substituted for mercury in a liquid slip ring system with excellent results under ultrahigh vacuum conditions. The gallium rotary electrical contact consists of a copper ring mounted on a rotating shaft that is immersed in a copper cup containing gallium. (See figure.) Some mild abrasion of the copper surface, while it is in contact with the liquid gallium, is necessary for the gallium to wet the copper surface. The gallium is initially liquified by a small electric heater mounted on the gallium cup and will remain liquified because of the heating effect of the electrical current flowing through the slip ring, so that the heater can then be shut off.

This type of slip ring has operated in a vacuum of 10^{-11} torr, periodically carrying currents of 25 amperes dc, for a period of two years with no maintenance. A moderate amount of outgassing occurs during the initial period of contact rotation and as the contact temperature increases, bakeout of the vacuum system in which this type of rotary slip ring is used must be

(continued overleaf)

limited to 250°F because of gallium corrosion problems with copper which have been encountered at higher temperatures. Routine bakeouts of 250°F have been used with this type of slip ring for two years with no apparent degradation of the slip ring components.

Notes:

1. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10138
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B69-10138

Patent status:

No patent action is contemplated by NASA.

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